ATK Mission Research

MRC/WDC-R-556

MAGIC USER'S MANUAL 2006

Author(s):   Larry Ludeking
                     ATK Mission Research

Contract No.:   F49620-03-C-0030
                     Final Technical Report

Submitted to: Air Force Office of Scientific Research
                     4015 Wilson Blvd.
                     Arlington, VA. 22203-1954

Submitted by: ATK MISSION RESEARCH
                     8560 Cinderbed Road, Suite 700
                     Newington, Virginia 22122

Date: December 2006

20070131197

M A G i C

ATK MISSION RESEARCH

The MAGIC User's Manual

This is the Help File for the Magic Tool Suite for Windows. It uses the standard Windows Help so it is pretty self-explanatory. You can use the panel to the left to scan through the table of contents. To select a part, chapter, or section click on it. To use the index click on the index tab and type your search query into the text field. Make a selection from the list and press the 'Display' button. If there are more than one pages linked to the keyword you selected then a dialog box will appear prompting you to choose which page you would like to view. Within the pages there are many links which will take you to a related page. If you find any dead links please email them to magic.support@atk.com.

Quick Reference:

Go to   Command Index
Go to   Table of Contents
Go to   Part 1. Using MAGIC
Go to   Part 2. MCL Commands
Go to   Part 3. Time and Space
Go to   Part 4. Spatial Extensions
Go to   Part 5. Properties
Go to   Part 6. Algorithms
Go to   Part 7. Output
Go to   Part 8. Example Simulation Files
Go to   Part 9. Tutorials

Internet access links:

Website: Visit the Magic Web Site
Email: magic.support@atk.com
© 1988-200\5   ATK Mission Research

Mailing Address:

Address: MUG Help
                 ATK Mission Research
                 8560 Cinderbed Rd., Suite700
                 Newington, VA 22122
                 Telephone: 703-339-6500

Preface

This User's Manual documents the 2004-2006 versions of MAGIC2D and MAGIC3D. MAGIC2D is a

two-dimensional code and MAGIC3D is its three-dimensional counterpart. The same Manual applies to both. You will encounter references to "2D simulations," which currently can be performed only with MAGIC2D, and to "3D simulations," which currently can be performed only with MAGIC3D. With this manual, we continue toward the goal of unification of the two codes. Virtually all the algorithms and material models are available in both MAGIC2D and MAGIC3D. While some features are currently available in only one of the codes, our goal is to make all features universal. The User's Manual has been rewritten to reflect various command changes, new models and algorithms.

Mugman: The MAGIC Tool Suite Manager.

The MAGIC Tool Suite Manager is the browser for viewing the electronic MAGIC User's Manual. It allows the user to examine the manual by part or by individual command. In addition, it includes a set of example files that can be exercised directly from the Tool Suite Manager. The Tool Suite Manager will start MAGIC2D or MAGIC3D for the particular example selected. In addition, it allows the user to browse through the MAGIC tutorials that are also supplied in electronic form.

Bug fixes and New and Revised Commands.

- Added to IMPORT .. SPOTS options (MAGIC3D only). This is make it easier to inject multiple beam spots at an import plane.
- Added MOVIE option + timing controls to OBSERVE. Also, added CODEC control for MOVIES that are converted to AVI. The default CODEC was changed to MSVIDEO1.
- Added default EXTRACT and SAVE names for diagnostics.
- Added beam axis direction to FOIL command. This relaxes the restriction on foils being 1 cell thick and conformal. Change is not backward compatible, users will need to make adjustments to earlier simulation files.
- Corrected a problem that occurred when OBSERVE INTERVAL n>1. The diagnostic Q_OF_SIGNAL would fail if the user examined the diagnostic prior to the end of the simulation.
- Corrected a problem in Magic3d, for EMISSION BEAM .. TIMING ktime. When ktime was greater than 1, the model was creating ktime*current. Particles were created on each time step.
- Add NOKILL option to CONDUCTORS (MAGIC3D only). This allows particles to stream ballistically through a thin conductor. This should only be used as an internal conductor option.
- Altered FOIL command so that it now requires specification of the beam transit axis. This then permits any volume shape to be used in defining a FOIL.
- Added MOVIE_NAME option to CONTOUR, RANGE, PHASESPACE, and VECTOR.
- Mugman modified to allow remote update of parallel cluster cpu's to use the identical version of MAGIC.
- Added TWO_PORT option to SMATRIX. This is used only for cold tests to get the complete Smatrix. Assumes that there are two ports at which incoming waves may be injected.
- Repaired IMPORT failure to trap the error that occurred when the beam energy was not defined.
- Repaired BEAM emission shape profile problem.
- Added additional data options for OBSERVE SMATRIX. These are: S11_REAL_IMAGINARY, S11_MAGNITUDE_PHASE, S21_REAL_IMAGINARY, and S21_MAGNITUDE_PHASE.
- Extract data option now decimates extracted data according to the selected interval. Thus if you extract with data interval 'n', you get every nth datum into the extract file. Most useful for OBSERVE.
- Fixed MAGIC2D - intermittant emission with secondary emission.
- Fixed a problem with MAXWELL Quasi_Static, resulted in inproper evaluation of functions with the

time argument.

- Fixed MAGIC2D and MAGIC3D EMISSION SECONDARY, the default secondary electron energy distribution was poorly resolved and a gave a vary obvious stairstepped sample. Increased the sampling resolution.
- Fixed parallel sew of VECTOR and CONTOUR plots in MAGIC3D.
- Fix problem with PORT normalization in MAGIC3D. Did not properly check to ensure Voltage measurement of V/m measurment lay within the Port area. Only caused problems if normalization was outside of PORT area
- Added volume type ROTATE to MAGIC3D. Designed for use in cartesian coordinates. Command looks like: "Volume name ROTATE area_stencil Point0_axis_of_rotation Point1_axis_of_rotation;"
- Added to MAGIC3D PRESET command the magnetic field type "MAGNUMBNEW", (new data format for Magnum code.
- Fix problem with IMPORT when used with parallel processing in MAGIC3D.
- Merged the table and species features. This allows the 3d particle viwer to be used in ReView 3d viewer.
- Added a NORMALIZATION options to the VECTOR command. This allows a fixed scaling to be applied to all the vector plots.
- Corrected a problem with MAGIC3D Phasespace interactive selection. Shows only the selected plots and only on kinematic timesteps.
- Corrected a problem with the PHASESPACE … WINDOW option. The choices of windows for Q, KE, and GAMMA were not available.
- Added automatic processing of movie bitmap files into an avi-file.
- Corrected a problem in MAGIC2D, where PRESET with ADD option replaces rather than superimposes the fields.
- Corrected a problem with the TABLE command for column style output.
- Corrected a problem with the TEMPERATURE option of EMISSION EXPLOSIVE for MAGIC2D.
- Corrected a problem in MAGIC2D for OUTGOING that causes a failure if the boundary exceeds 199 cells in length.
- Added an OBSERVE SMATRIX diagnostic for cold tests.
- Corrected an intermittant problem with Magic2D, associated with PORTS ands SYMMETRY PERIODIC boundaries for large numbers of grid mesh.
- Corrected a problem with IMPORT FILE in Magic3D. When timestep of the FILE data is different from the mesh generated timestep, the current scaling of Contour plots was incorrect.
- Reviseed MUGMAN so that uses a local copy of a MAGIC executable in the input file folder, rather than the copy in the MAGIC Tools folder.
- Added option to AUTOGRID, allowing you to EXTEND a grid partially generated with the GRID command, and then completed with the AUTOGRID command.
- Corrected an error in RANGE … FFT. Changes the display so that is uses wave-number rather than inverse wavelength.
- Added another option to IONIZATION … EMPIRICAL_BETA_MIN.
- Corrected a problem with the PRINT screen option.
- Secondary emission failing when the primary charge is too small in Magic2d. This problem has been repaired. Symptom was no secondary particles.
- Fixed bug in CONTOUR HISTOGRAM for MAGIC3D
- Added GAS_CONDUCTIVITY model for MAGIC2D
- *B-factory Klystron template.*
- An EMISSION [option] has been added [FIXED_CHARGE_SIZE q].
- Please note that this version uses a NEW set of registry entries, that are not compatible with version

7.00 and earlier.

- Uninstall earlier versions of MAGIC prior to installing this one. Piecemeal update of the executables is not available for this version.
- Added Emission Temperature for Explosive emission.
- Added MUGMAN new features. Includes treeview rendering of the input file, also colored text format option to identify commands and keywords.

Acknowledgements

Table of Contents

Part 7. Output

Command Index

$namelist$	OBSERVE [options]
!	OBSERVE INTERVAL
	OBSERVE CIRCUIT
AREA	OBSERVE COLLECTED
ASSIGN	OBSERVE EMITTED
AUTOGRID	OBSERVE FIELD
	OBSERVE FIELD ENERGY
BLOCK / ENDBLOCK	OBSERVE FIELD INTEGRAL
	OBSERVE FIELD POWER
CABLE	OBSERVE FILE
CAPACITOR	OBSERVE IMPEDANCE
CALL / RETURN	OBSERVE INDUCTOR
CHARACTER	OBSERVE INTERVAL
CIRCUIT	OBSERVE IONIZATION
COILS	OBSERVE NEUTRAL GAS
COMMAND	OBSERVE PARTICLE STATISTICS
COMMENT / C / Z / !	OBSERVE RESONANT PORT
CONDUCTANCE	OBSERVE RESISTOR
CONDUCTOR	OBSERVE SECONDARY
CONTINUITY	OBSERVE SMATRIX
CONTOUR [OPTIONS]	OBSERVE SPACE HARMONIC
CONTOUR FIELD	OBSERVE TRAMLINE
CONTOUR HISTOGRAM	OBSERVE TRANSFORM
CONTOUR NEUTRAL GAS	OUTGOING
CONTROL	
CURRENT SOURCE	PARALLEL GRID
	PARAMETER
DAMPER	PHASESPACE
DIELECTRIC	PHOTON
DELIMITER	POINT
DISPLAY	POISSON
DO / ENDDO	POLARIZER
DRIVER	POPULATE
DUMP	PORT
DURATION	PRESET
ECHO / NOECHO	RANGE [options]
EIGENMODE	RANGE FIELD
ELSE, ELSEIF, ENDIF	RANGE FIELD INTEGRAL
EMISSION [options]	RANGE FIELD POWER
EMISSION BEAM	RANGE HISTOGRAM
EMISSION EXPLOSIVE	RANGE NEUTRAL GAS
EMISSION GYRO	RANGE PARTICLE
EMISSION HIGH FIELD	RANGE TRAMLINE
EMISSION PHOTOELECTRIC	REAL
EMISSION SECONDARY	RESISTOR
EMISSION THERMIONIC	RESONANT PORT

EMIT	
EXPORT	SHIM
	SPECIES
FILM	START / STOP
FOIL	STATISTICS
FREESPACE	SURFACE_LOSS
FUNCTION	SYMMETRY
	SYSTEM
GAS_CONDUCTIVITY	
GRAPHICS	TABLE FIELD
GRID ORIGIN	TABLE PARTICLES
GRID EXPLICIT	TAGGING
GRID UNIFORM	TERMINATE
GRID QUADRATIC	TIME_STEP
GRID PADE	TIMER
	TRAMLINE
HEADER	
	VECTOR
IF / ELSEIF / ELSE / ENDIF	VIEWER
IMPORT	VOID
INDUCTOR	VOLUME
INTEGER	VOLUME ANNULAR
IONIZATION	VOLUME annular_section
	VOLUMe conE
JOIN	VOLUMe conformal
	VOLUMe cylindrical
KEYBOARD	VOLUMe extruded
	VOLUMe functional
LINE	VOLUMe hElical
LIST	VOLUMe lathE
LOOKBACK	VOLUMe paralleLepipedal
LORENTZ	VOLUMe prvamid
	VOLUMe rhombus
MARK	VOLUMe rotatE
MATCH	VOLUMe spherical
MATERIAL	VOLUMe tetrahedron
MAXWELL CENTERED	VOLUMe toroidal
MAXWELL FIXED	VOLUMe wedgE
MAXWELL QUASI_NEUTRAL	VOLTAGE
MAXWELL QUASI_STATIC	
MAXWELL HIGH_Q	Z
MAXWELL BIASED	
MCLDIALOG	
MODE	

System Requirements:

Windows NT, Windows 2000, or Windows XP

90 MHz or above

64 Mb RAM, bare minimum

A USB port for the Hardware Key (for licensed version only)
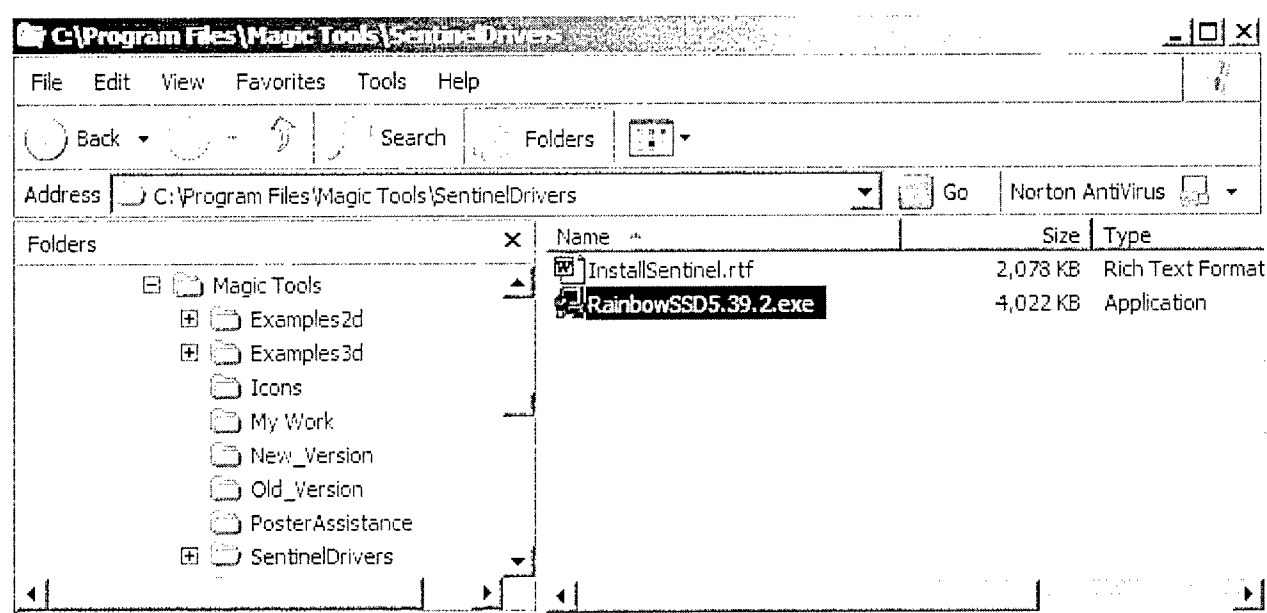
Export Compliance Information and this Product

Warning: This information may be controlled for export by the Arms Export Control Act (Title 22, U.S.C., App. 2751 et seq.) or the Export Administration Act of 1979, as amended, Title 50, U.S.C., App. 2401 et seq. Export of this information to a foreign person inside or outside the United States must be in accordance with the International Traffic in Arms Regulation (ITAR) or Export Administration Regulations (EAR).
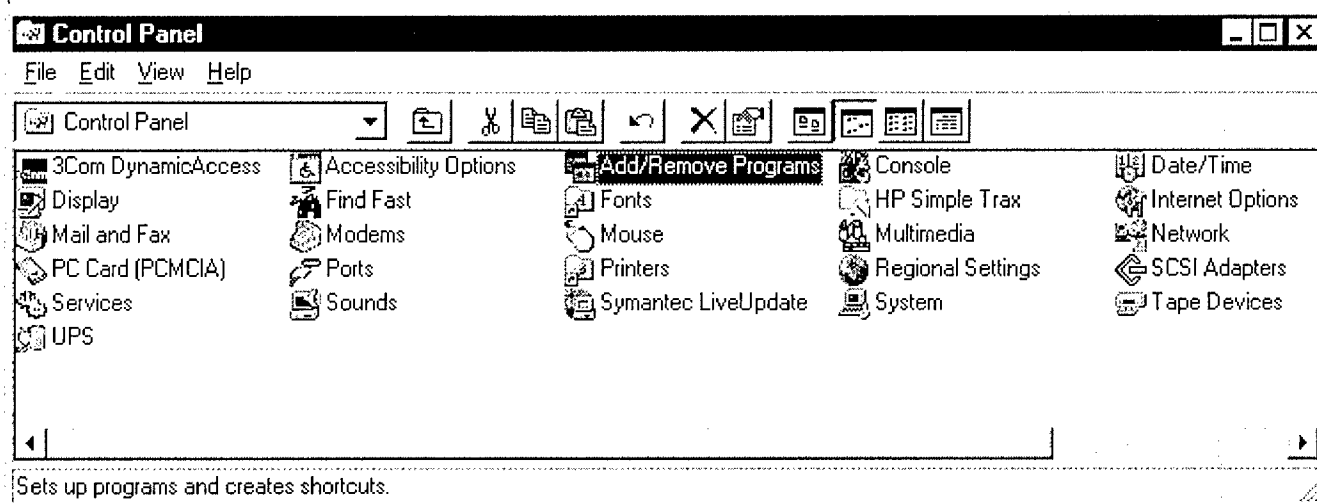
The Sentinel System Drivers

The Sentinel System Drivers provide a communication path between MAGIC and the Sentinel key. It is necessary to install the drivers if and only if you have been supplied a hardware key with the Magic Tool Suite purchase. For demonstration copies of the Magic Tool Suite you need not install the drivers. Note! The demonstration copies of Magic are hardware locked to run only tiny problems. For full size simulations, you must license the software to obtain a hardware key.

Quick Installation Procedure for
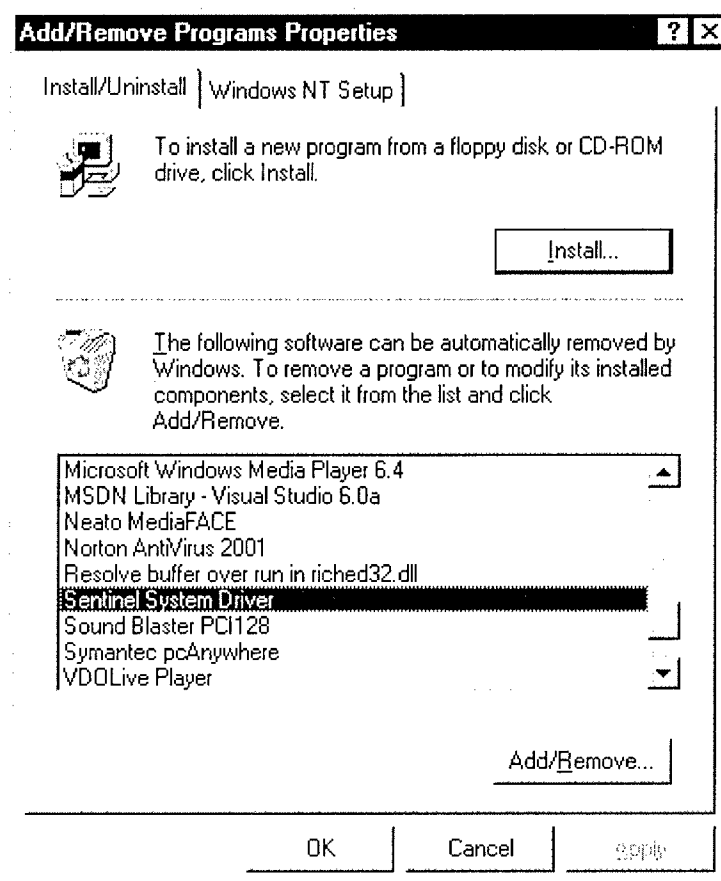## The Sentinel System Drivers for the MAGIC Hardware Key

1. Using Windows Explorer go to the MAGIC Tool Suite Installation Folder. If you installed on the C Drive the path should be: **C:\Program Files\MAGIC Tools\SentinelDrivers"** and your explorer window should look like the following figure. Using your mouse highlight the file RainbowSSD5.39.2.exe and run it.

2. Running this will install the required drivers.

3. To verify the installation of the Sentinel Drivers Open the **Control Panel** and using the mouse click on the item "Add/Remove Programs". You should see a window that resembles the following.
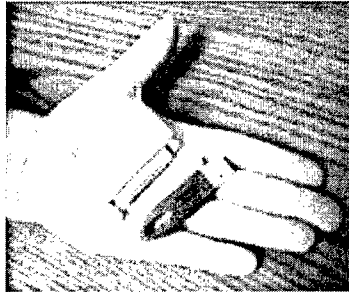
Control Panel

File Edit View Help

Control Panel

3Com DynamicAccess | Accessibility Options | Add/Remove Programs | Console | Date/Time
Display | Find Fast | Fonts | HP Simple Trax | Internet Options
Mail and Fax | Modems | Mouse | Multimedia | Network
PC Card (PCMCIA) | Ports | Printers | Regional Settings | SCSI Adapters
Services | Sounds | Symantec LiveUpdate | System | Tape Devices
UPS

Sets up programs and creates shortcuts.

4. The next screen will be the "Add/Remove Programs Properties" dialog box. Scroll down the display list and verify that the item "Sentinel System Driver" is present.

Add/Remove Programs Properties

Install/Uninstall | Windows NT Setup

To install a new program from a floppy disk or CD-ROM drive, click Install.

Install...

The following software can be automatically removed by Windows. To remove a program or to modify its installed components, select it from the list and click Add/Remove.

Microsoft Windows Media Player 6.4
MSDN Library - Visual Studio 6.0a
Neato MediaFACE
Norton AntiVirus 2001
Resolve buffer over run in riched32.dll
Sentinel System Driver
Sound Blaster PCI128
Symantec pcAnywhere
VDOLive Player

Add/Remove...

OK | Cancel | Apply

5. You are done. At this time you may wish to reboot your computer. Before restarting ensure that the hardware key has been installed on your computer.

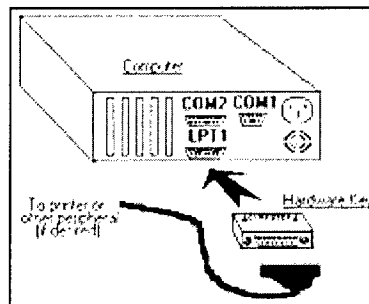**Install the Sentinel MAGIC Hardware Keys**

Distribution of this software is limited. Redistribution is not authorized unless prior arrangements have been made with Mission Research Corporation.

Installing the Hardware Key Sentinel drivers. Using Windows Explorer, find the MAGIC Tools folder in which you installed the MAGIC Tool Suite. Locate the folder named "SentinelDrivers", run the file "RainbowSSD5.39.2.exe". Confirm the path information, if requested. Quit when complete.

Installation of Hardware Key (Parallel Port or USB Port Key). Hardware keys are supplied with the licensed versions of MAGIC. To install the hardware key, you must first turn off your PC.

Parallel Port Key. Attach the hardware key to your PC's parallel printer port, usually labeled "LPT1". The end of the key to be attached to the port is labeled "COMPUTER" (see Figure). A printer or other peripheral device can be attached to the other end of the key, if desired.

USB Port Key. Insert USB port key is USB port slot.

Restart your PC.

Part 1. Using MAGIC

1. INTRODUCTION

1.1 MANUAL OBJECTIVE

This Manual documents the most recent release of the MAGIC2D and MAGIC3D codes. The codes and Manual are usually released annually. The version (month and year of release) is imprinted on the cover of this document and on virtually all output from the code. Interim versions of the code may be released without documentation to correct errors, to permit use of new algorithms, and to allow beta testing. Users who encounter errors in the code or Manual are encouraged to communicate these to Mission Research Corporation by fax at (703) 339-6953 or e-mail at magic@mrcwdc.com.

Insofar as it is possible, the code is designed to be backwards compatible with the Manual. This means that features in previous Manuals will probably work in the latest version of the code. Backwards compatibility is the reason that old input files can continue to run, even though many of the commands are technically obsolete and have been dropped from the Manual. The Manual reflects the future, while the code is a mixture of old and new features.

The Manual assumes that the reader may have no prior experience with the code, but that he is acquainted with computational physics methods in general and electromagnetic, particle-in-cell methods in particular. There is little attempt to motivate or even to justify the conventions and algorithms offered. Instead, the focus is upon how to use the code, and the user having previous experience with the code may wish to proceed to Part 2.

1.2 MANUAL ORGANIZATION

This Manual consists of nine Parts, and it is further subdivided into 31 Chapters.

Part 1 (Using the Code) is intended primarily for new users. It focuses on "how to" and is relatively devoid of theory and derivations.
- Chapter 1 is the introduction.
- Chapter 2 describes how to create a simulation. It presents most of the important choices that go into a simulation and includes cross-references to actual commands. It also presents the most important conventions and the most common user errors.
- Chapter 3 describes how to execute the simulation, how to recognize errors, and how to continue the simulation further in time.
- Chapter 4 offers an abridged discussion of the MAGIC Command Language (MCL), which includes the use of constants, variables, and functions, and provides a basis for advanced data processing methods.
- Chapter 5 discusses the rules of syntax, or how to interpret arguments in the Manual to write commands that work.

Parts 2 through 7 contain the command descriptions. The Parts and Chapters are organized by function, thus making it easy to compare the alternatives available. Each command description includes command_name, function, syntax, arguments (definitions), description, restrictions, see also (cross-references), references (to literature), and examples. The Parts are as follows:

- Part 2 (MCL commands)　　　— variables, functions, do-loops, etc.
- Part 3 (time and space)　　　— spatial objects (points, lines, areas, volumes) and grids
- Part 4 (spatial extensions)　　— outer boundaries and transmission lines
- Part 5 (properties)　　　　　— conductors, dielectrics, resistive properties, emission processes
- Part 6 (algorithms)　　　　　— electromagnetic, current-density, and particle kinematics

- Part 7 (output)   — an extensive selection of simulation output types and methods
- Part 8 (graphics interface)   — illustrates how to use the graphics interface and shows the capabilities
- Part 9 (examples)   — has links to 2d and 3d examples, allows you to run these examples from the electronic help manual

1.3   SOFTWARE DESCRIPTION

MAGIC[1] is an electromagnetic particle-in-cell code, i.e., a finite- difference, time- domain code fo simulating plasma physics processes, i.e., those processes that involve interactions between space charge an electromagnetic fields. Beginning from a specified initial state, the code simulates a physical process as it evolve in time. The full set of Maxwell's time-dependent equations is solved to obtain electromagnetic fields. Similarly the complete Lorentz force equation is solved to obtain relativistic particle trajectories, and the continuity equatio is solved to provide current and charge densities for Maxwell's equations. This approach, commonly referred to a electromagnetic particle- in- cell (PIC), provides self- consistence, i.e., interaction between charged particles anc electromagnetic fields. In addition, the code has been provided with powerful algorithms to represent structure geometries, material properties, incoming and outgoing waves, particle emission processes, and so forth. As result, the code is applicable to broad classes of plasma physics problems.

The MAGIC tool suite includes MAGIC2D, a two- and one-half dimensional code (2D fields and 3I particle kinematics), MAGIC3D, a fully three-dimensional counterpart to MAGIC2D, and ReView[2], a general purpose post- processor. It reads from the MAGIC standard database format. It can redisplay simulation graphic: after a simulation is complete. All codes in the MAGIC tool suite are built on an application- independent softwar library. This includes the command language interpreter from which the user interface for each code is built and th DUMP utility which provides communication between the codes and the database. The use of this library speed: code development, but more importantly, it helps integrate the system and makes the codes similar to learn and use.

The MAGIC Tool Suite for Windows consists of several software applications. The principle ones are:

InputBuilder – This application is an alternative version of the MAGIC Tool Suite Manager, MUGMAN. I contains a browser for the electronic copy of the MAGIC User's Manual. It also allows the user to launch the tin versions of MAGIC2D and MAGIC3D, as well as POSTER. Input files may be edited using the MAGIC Tool Suit Manager and new ones constructed, saved, and run with the appropriate application. The builder enforces particular format on input files that make them easier to read and edit. InputBuilder and Mugman are very similar i appearance and functionality. If you already familiar with Mugman, you will be able to use InputBuilder in similar fashion.

MUGMAN – This application is the MAGIC Tool Suite Manager. It contains a browser for the electroni copy of the MAGIC User's Manual. It also allows the user to launch the tiny versions of MAGIC2D an MAGIC3D, as well as POSTER. The MAGIC Tool Suite Manger includes a set of example input files for both 2I and 3D, and provides online copies of the MAGIC Training Seminars. Input files may be edited using the MAGIC Tool Suite Manager and new ones constructed, saved, and run with the appropriate application.

MAGIC2D_SNG and MAGIC2D_DBL - are the single and double precision versions of MAGIC2D.

MAGIC3D_SNG and MAGIC3D_DBL - are the single and double precision versions of MAGIC3D.
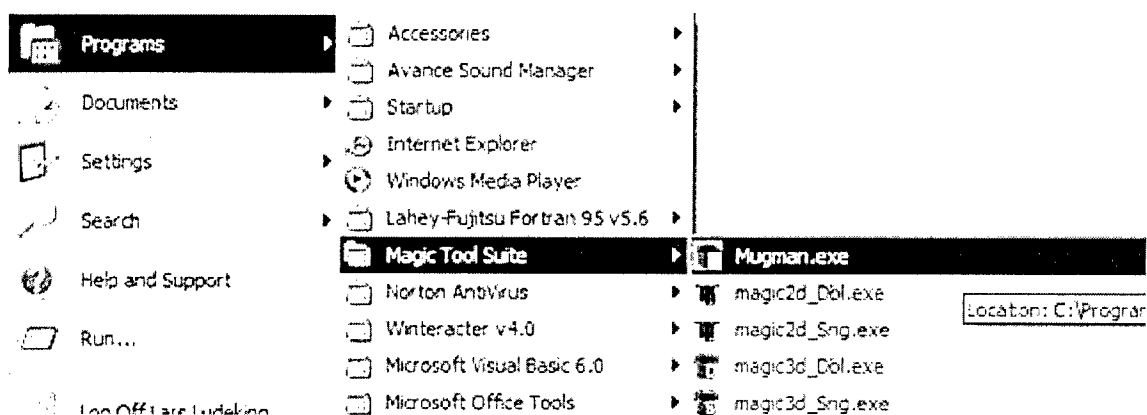
REVIEW_SNG and **REVIEW_DBL** - are the single and double precision versions of Review, the interactive post-processor for the MAGIC database format. This application replaces POSTER.

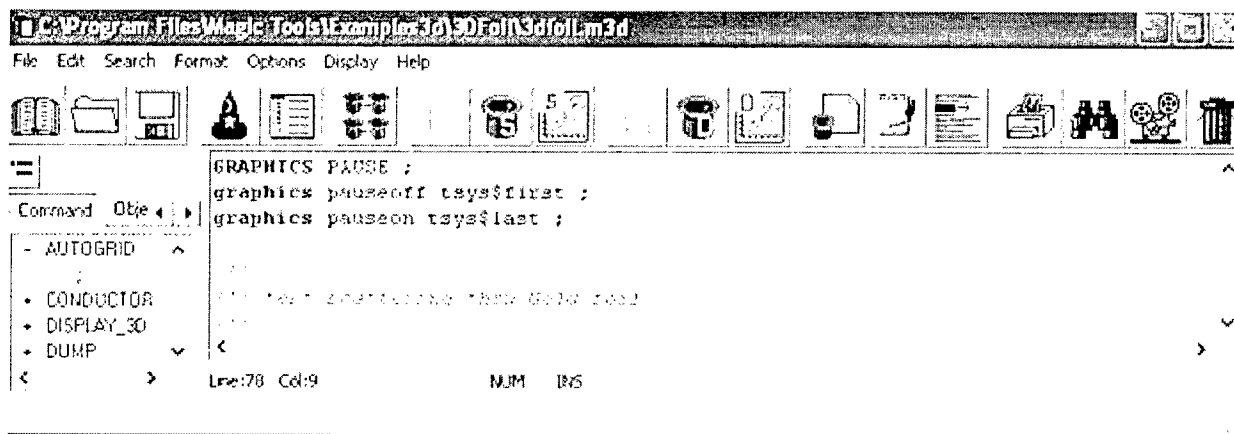## 1.4 STARTING "MUGMAN", THE MAGIC TOOL SUITE MANAGER

Launch the MAGIC Tool Suite Manager as follows:

- Begin with the Windows START menu button,
- Select the PROGRAMS menu,
- Select the MAGIC Tools menu,
- Click on "Mugman.exe".

The following figure illustrates what this will look like on your monitor.

Once the MAGIC Tool Suite Manager starts, it displays a window like the following one. This window may b resized just like any other Windows application to provide a bigger viewing area. Mugman is a text editor witl built-in features that make it easier to construct, edit, and run Magic Input files.

The text editor (right-side window) in Mugman only allows you to edit one file at a time. The outline view (left side window) lists all the commands in the file, if the Command tab is the selected tab at the top of the outlin view. Clicking the plus sign to the left of a command in the outline view opens branches to all lines using tha command. Double-clicking a branch in the outline view moves the text editor cursor to the corresponding comman

line. Each time you exit Mugman, it remembers the name of the file you are currently working on, and automatically reopens this file the next time. The name and location of the current file is displayed in the title bar a the top of the window. The File, Edit, and Search menus provide the standard commands found in most tex editors. These commands will be explained in the Menus section below. The Options menu allows you to change the appearance and behavior of Mugman. The Display menu provides refreshing of the text color, and of the outlin view. The Help menu provides access to the Magic Manual, an extensive help manual that contains beginner' information, a full list of the Magic commands and their arguments, explanations of certain algorithms used ii Magic, and access to a large number of example simulations that are a good starting point for building your ow simulations.

1.4.1 The Mugman Toolbar

The Mugman Toolbar, located directly underneath the menu, contains buttons that perform the most commonly use editor functions in Mugman, as well as buttons to launch Magic and Review. The table below shows each button' function.

Toolbar Button Functions and Descriptions

Button	Name	Action
	Manual	Opens the Magic Users Manual in a separate window. Pressing this button is the same as selecting Help menu item Magic Help Manual or pressing function key F1.
	Open	Open a new file. Mugman can only edit one file at a time, so you will be prompted to save changes before the current file is closed. Pressing this button is the same as selecting File menu item Open.
	Save	Save the currently open file. If the file is unsaved, a dialog will prompt you to select a location and filename. Pressing this button is the same as selecting File menu item Save.
	Open Command Assistant	Open a command dialog related to the current text command, to assist in replacing the current command line (if the command word was selected in the text editor) or in adding a command line. Do not use this button for commands BLOCK, MCLDIALOG, or $namelist, as those command lines must be typed into the text editor window by hand. Pressing this button is the same as selecting Edit menu item Command Assistant or pressing F2.
	Show/Refresh Outline View	Open or refresh the outline view. When a command dialog is used to replace or add a command line, the outline view automatically refreshes. So, this refresh button only has to be used if text was typed into the text editor window by hand. Pressing this button is the same as selecting Display menu item Refresh Outline View or pressing F4.
	Open Parallel Processing	Open a dialog box that allows you to choose which computers in your network will be used for a parallel run of your

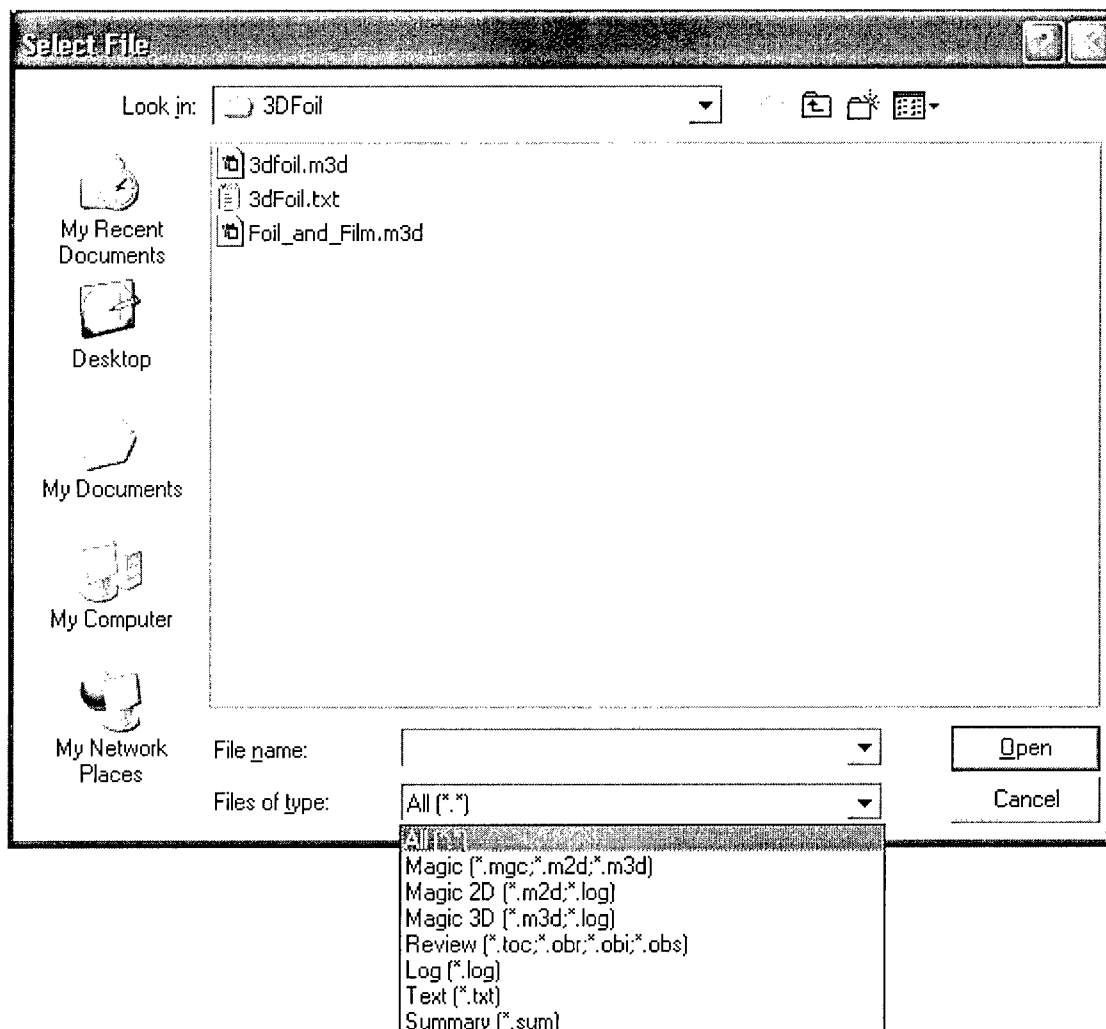|		
	Dialog Box	MAGIC3D file. All of the computers on your network must have been previously listed by selecting Options menu item "Configure Parallel Cluster …".
	Magic2D_Sng	This button starts MAGIC2D single precision. If the open file in Mugman is a .m2d or .mgc file, it will be used as the input file.
	Magic3D_Sng	This button starts MAGIC3D single precision. If the open file in Mugman is a .m3d or .mgc file, it will be used as the input file.
	ReView_Sng	This button starts ReView single precision. If the open file in Mugman is a .toc file, it will be used as the input file.
	Magic2D_Dbl	This button starts MAGIC2D double precision. If the open file in Mugman is a .m2d or .mgc file, it will be used as the input file.
	Magic3D_Dbl	This button starts MAGIC3D double precision. If the open file in Mugman is a .m3d or .mgc file, it will be used as the input file.
	ReView_Dbl	This button starts ReView double precision. If the open file in Mugman is a .toc file, it will be used as the input file.
	Open Log File	Open the log file that resulted from running the MAGIC2D or MAGIC3D input file currently residing in the text editor. Pressing this button is the same as selecting File menu item Open Log.
	Wordpad	This button starts the wordpad text editor. This is useful for viewing RTF files, since Mugman can only display them.
	Indent Selected Lines	Indent/Unindent the selected text editor lines.
	Print	This button opens a print dialog that allows you to set printer options and print the currently open file in Mugman. Pressing this button is the same as selecting File menu item Print.
	Search	This button is used to search the text for a specific word or phrase. Pressing this button is the same as selecting Search menu item Find.
	Play AVI File	This opens a list of AVI movie files in the current folder, and plays the selected file.
	Delete Files	This opens a check-list of files in the current folder, and deletes the user-selected files. Pressing this button is the same as selecting File menu item Delete Files.

1.4.2 MUGMAN Menu Commands

The Mugman main menu contains seven different groups of commands. If the main menu is not currently displayed, clicking inside the text editor (right-side window) will cause it to appear. The File, Edit, and Search menus contain standard text editor commands:

File Menu

New: This will create a new, blank document. Since Mugman can only edit one file at a time, Mugman will close the currently open document before the new document is created. If any changes have been made to the current document, the user will be asked if they wish to save their changes before closing the file.

Open: This will open a file browser to select a new file to open. If you are looking for a particular type of MAGIC input or output file, you can select the type in the browser, as shown in the following figure.

Open Log: Open the log file that resulted from running the MAGIC2D or MAGIC3D input file currently residing in the text editor.

File History: This will open a dialog that lists the last 20 files opened in Mugman. Select the file to open next in Mugman.

Batch Runs: This will open a dialog for listing the Magic files that you would like to run consecutively.

Save: This will save any changes to the currently open file. If the file is unsaved, a file browser will prompt you to

select a location and enter a filename.

Save As: This will open a file browser for the user to select a location and filename. If the filename already exists you will be asked to confirm before replacing the file.

Delete Files: This opens a check-list of files in the current folder, and deletes the user-selected files.

Print: This will open a print dialog that allows you to print the current document, setup the page layout, or select a different printer.

Print Selection: This option will only print a selected block of text.

(File History Mini-List): These dynamic items list the last 6 files that have been opened in Mugman. The user car select one of those files to open next.

Exit: Quit Mugman. If changes have been made to the currently open file, you will be asked if you wish to save your changes before quitting.

Edit, Search and Format Menus

The Edit and Search menus contains the standard commands available in any text editor. The editor supports multi level undo, which allows you to undo changes made to a file one step at a time. Lines can be selected, and the indented/unindented. Command Assistant (F2) opens a command dialog related to the current text command, to assist in replacing the current command line (if the command word was selected in the text editor) or in adding command line. Do not use this function for commands BLOCK, MCLDIALOG, or $namelist, as those comman lines must be typed into the text editor window by hand. New Command... provides access to command dialogs either alphabetically by command name, or by category. Text can also be cut, copied, or pasted to or from othe programs. The Edit Menu can also be accessed by right-clicking in the text editor. The Search Menu allows you to search for a text string in the currently open file, from the current position in the file. You can search either up o down from the current position, specify an exact or case insensitive match, or search only for a whole word match. The Format Menu permits selection of font type and size.

Options Menu

The Options Menu allows choices for using the command dialogs, for continuing a command over more than one text line, for enabling the outline view, for coloring the text, and for listing the parallel computer network. The Options Menu is shown in the figure below.